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GROWING BUCKWHEAT

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BUCKWHEAT IS GROWN principally in the northeastern part of the United States, more than 60 percent of the crop being produced in Pennsylvania and New York.

Buckwheat does best where the climate is cool and humid and is more sensitive to climatic than to soil conditions. It is one of the best grain crops for poor land and does well on acid soils. It can make use of the less readily available phosphorus and potassium better than other grain crops.

Because of a short growing season—10 to 12 weeks—buckwheat may be seeded late in the season after an earlier sown crop has failed. For this reason it is very useful as a catch crop.

The grain is used for human food as pancake flour and groats. The milling byproducts or the whole grain is fed to livestock and especially to poultry. The straw has feed and fertilizing value.

Buckwheat is valuable as a weed destroyer, soil renovator, green-manure crop, and honey crop.

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GROWING BUCKWHEAT

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BUCKWHEAT (*Fagopyrum* spp.) is one of the less important grain crops grown in the United States. Because of its minor importance, knowledge of the crop is rather limited. As it is unable to compete with other grain crops on more favorable land and is able to do fairly well on thin, stony, and rolling land, it is usually found growing back in the hills of the eastern United States. Although the crop has little national importance, it is of considerable value in certain limited areas of the country. Little has been published on cultural experiments with the crop, and very few attempts have been made at varietal improvement. In the discussion that follows, an attempt is made to summarize the latest information on the growing and the uses of buckwheat.

IMPORTANCE OF BUCKWHEAT

Buckwheat probably originated in the mountains of central and western China. It was brought to the United States from Europe by the early colonists but does not seem to have been an important crop in colonial days and is seldom mentioned in early records. The production of the crop increased, however, with the growth of the country until about 1866, when it was grown on nearly 800,000 acres. From that time until 1917 and 1918 the acreage remained nearly constant. More than a million acres were grown in 1918. Since then the general trend in buckwheat acreage has been downward. At present the crop is grown on approximately half a million acres, and the total production is 6 to 8 million bushels.

For every bushel of buckwheat raised in this country there are produced about 300 bushels of corn, 100 bushels of wheat, 150 bushels of oats, 35 bushels of barley, and 5 bushels of rye. The average acreage

of buckwheat per farm on which buckwheat is grown is but 6.2 acres, which is considerably less than that of any of the other small grains. It is therefore of minor importance as compared with other crops. It is none the less important in certain areas and is useful in several ways. Buckwheat cakes will always be in demand in American homes.

Buckwheat is not an important crop in world agriculture, although it is raised in several countries. The Soviet Union has the largest production, with France ranking second, Poland third, Canada fourth, and the United States fifth. At present, the production in Canada and in the United States is nearly equal. Other countries producing buckwheat are Japan, Austria, Germany, and Rumania.

The largest average acre yield of buckwheat in the United States was 22.9 bushels in 1912. During the 10-year period 1923-32 the average yield was 15.7 bushels an acre. Yields of 25 to 30 bushels per acre are common under good growing conditions. Reports are available indicating yields of 80 or more bushels an acre on small fields and under very favorable conditions.

Buckwheat can be used to enlarge farm activities. On many farms time is available to prepare land and sow buckwheat after other crops that must be sown early are all planted. On account of its short growing season it may be sown later than any other grain crop and for this reason is often used as a catch crop to be seeded where other crops fail or cannot be planted in season because of wet weather or for other reasons.

AREAS OF PRODUCTION

Buckwheat is grown principally in the northeastern part of the United States, the leading buckwheat States being Pennsylvania, New York, Minnesota, Ohio, West Virginia, and Michigan. Figure 1

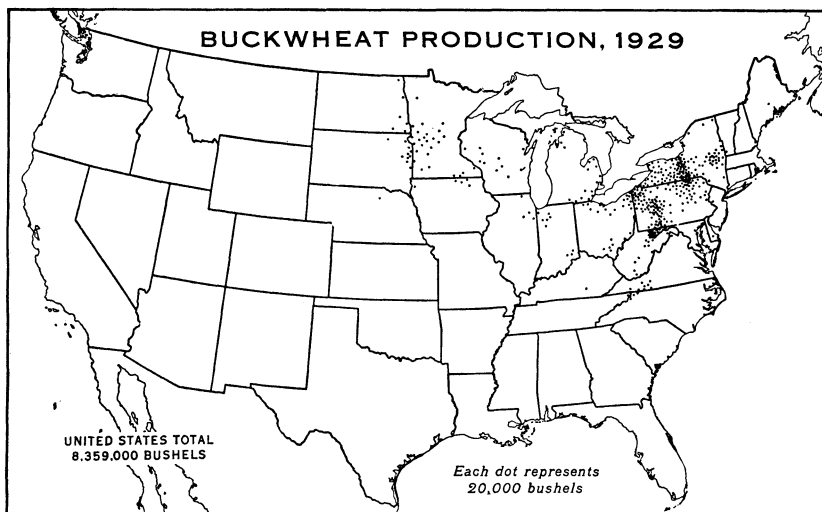


FIGURE 1.—Production of buckwheat in the United States in 1929 (census of 1930). Each dot represents 20,000 bushels. Production (bushels) in the leading States was: Pennsylvania, 2,537,287; New York, 2,452,508; Minnesota, 516,121; Ohio, 484,221; West Virginia, 409,757; Michigan, 317,356.

shows the distribution of the crop in 1929. The distribution changes from year to year because buckwheat often is sown after some other crop has failed, especially in areas where it is not extensively grown.

It will be seen from the map that even in the leading States the production is restricted to certain small areas. In New York the production is greatest in Cayuga, Steuben, Tioga, Seneca, and Tompkins Counties; in Pennsylvania, in Bradford, Somerset, and Crawford Counties. Another area of considerable acreage is in Preston County, W. Va., and Garrett County, Md., two adjoining counties.

The area of greatest production is in south-central New York and north-central Pennsylvania. Another area extends from northwestern Pennsylvania south and east through the State to the western counties of Maryland and north-central West Virginia. In general these areas of production follow the higher and rougher topographies.

Buckwheat can be grown with some success almost anywhere north of the Cotton Belt, and it is grown to some extent even there, especially as a cover crop. As agriculture moved westward the growing of buckwheat was tried with varying degrees of success by many farmers and experiment stations, but after better adapted crops and better varieties of these crops were obtained buckwheat received little attention. In the more northern States it can be grown generally without reference to elevation, but in the South it is best adapted to the uplands and mountainous sections.

CLIMATIC REQUIREMENTS

Buckwheat does best in a moist, cool climate. It is very sensitive to cold, being killed quickly when the temperature falls below freezing. Despite this, it is grown rather far north and at high altitudes. This is possible because of its short growing season of only 10 to 12 weeks and because of the small amount of heat required for the development of the crop. It is sensitive to high temperatures and dry weather at blooming time, especially when both day and night are hot or when hot, drying winds prevail. Hot weather with frequent rains is also unfavorable. Under such conditions many or all of the flowers then in bloom may be blasted and produce no grain. Rather high temperatures during the day apparently are not so destructive if the nights are cool, the winds not excessive, and the soil not too dry. Unfavorable weather in the principal flowering period tends to reduce materially the set of seed and the yield of grain. A few days of unfavorable weather at this time may reduce the yield seriously or even destroy the crop of grain altogether. Largely for this reason, buckwheat often is an uncertain crop, especially in regions where unfavorable weather conditions are likely to occur. Seeding is often delayed as long as it is safe to do so to avoid having the crop in bloom in unfavorable weather. This allows the principal growth to take place in warm weather and the seed to form in the cooler weather of late summer. In more recent years buckwheat has been seeded early in the spring, in some cases in a mixture with oats and barley, so as to allow the seed to set before the hottest weather begins. In Minnesota and South Dakota the crop is seeded early enough to bring it into bloom late in July.

SOIL ADAPTATION

Buckwheat will produce a better crop on infertile, poorly tilled lands than any other grain if the climatic conditions are favorable. It responds to good treatment, however, with increased yields. It is well suited to light, well-drained soils such as sandy loams and silt loams. It is not a good crop for heavy, wet soils. It needs but little lime, growing well where alfalfa and red clover would not succeed; in fact, it seems to prefer an acid soil. Soils in which limestone is abundant are not well suited to buckwheat. It is often sown on newly cleared land, on drained marshland, or on other land where the decaying leafmold or other vegetable matter render conditions unsuitable for most other grain crops.

The crop usually lodges badly on rich soils, especially those high in nitrogen. Buckwheat is in reality a crop for poor lands, for there it can compete successfully with other grain crops, whereas on rich land other crops usually are more profitable, except from late sowing.

SOIL PREPARATION

Buckwheat is often sown on carelessly and hastily prepared land or on land so rough and rocky that good preparation is impossible. It frequently produces fair crops under such conditions, but better returns can be expected when more care is taken in preparing the seedbed.

Best results can be obtained by plowing the land early in the spring and keeping it in condition by occasional harrowing until the crop is sown. A reserve of moisture is thus provided which will go far toward producing the crop. Good yields are often obtained, however, on land plowed and harrowed just before sowing. If plowing is done late, the land should be well worked to firm the seedbed. The preparation of the seedbed for buckwheat should be in general the same as for corn. Old meadow and pasture lands usually are very suitable for buckwheat. Fields where the yields of hay and grass are likely to be low often can be sown to buckwheat. Such land, if possible, should be plowed deep several weeks before sowing time and worked occasionally with the disk or harrow, to keep down weeds, conserve moisture, and prepare the seedbed.

Many buckwheat growers work the land in June, shortly before sowing the crop and after the silage corn or other late crops are planted. Where buckwheat is seeded early or in mixtures with oats and barley the soil preparation would be the same as for spring grain crops.

ROTATIONS

Buckwheat usually is not included in a definite rotation, although it frequently precedes potatoes. Very often it produces fair crops on land too poor to raise good crops of corn or wheat. When grown on such land, a rotation is hardly possible or advisable. Buckwheat is often grown year after year on the same land with little or no apparent ill effect, but it will exhaust the soil sooner or later if not properly fertilized. Rye is better suited than any other cereal to

the poorer soils on which buckwheat is largely grown. Consequently rye should often have a place in rotation with buckwheat.

A good rotation for much of the area suited to this crop is: First year, alsike or red clover; second year, buckwheat; third year, potatoes; fourth year, rye, oats, or wheat seeded to clover. Another rotation including corn might be: First year, corn with crimson clover sown at the last cultivation; second year, buckwheat followed by rye; third year, soybeans.

FERTILIZERS

When the soil is poor it often is advisable to use fertilizers for the buckwheat crop. Phosphorus is most likely to be needed in the buckwheat-growing sections and gives better results than other fertility elements. Phosphorus is useful in the production of grain by increasing the weight. The soils on which buckwheat is grown usually are deficient in this element, and its application is especially necessary.

Phosphorus is the only commercial fertilizer usually necessary for the buckwheat crop on soils of fair to good fertility. Sufficient phosphorus for a maximum crop is contained in 150 to 200 pounds per acre of superphosphate. The buckwheat plant is able to take up and use much more of the less soluble mineral phosphates than do other grain crops. Experiments at the New Jersey Agricultural Experiment Station indicate that buckwheat utilizes the less soluble phosphates of rock phosphate almost as readily as it does the freely soluble phosphates of superphosphate. The buckwheat crop may indeed serve as an excellent means of making the less soluble phosphates available.

Potassium is used by buckwheat in comparatively large quantities. It has been determined at the New Jersey station that buckwheat will readily use the less soluble potash present in the greensand marls. It is probable that buckwheat can secure sufficient potash for its requirements in practically all soils. If the land has been poorly farmed, it may be necessary to add a small amount to secure the best yields.

A little nitrogen in the soil is indispensable, and on poor land, where most of the buckwheat is grown, its application will increase the harvest. The growing of other crops, such as clovers or other legumes, in the rotation may make nitrogen available in sufficient quantity for buckwheat at a cost lower than that at which it could be supplied by fertilization. Excess nitrogen results in the development of straw to the detriment of grain. Lodging is likely to follow such excessive development, making harvesting difficult or impossible. Large applications of manure may be harmful in this way.

On very poor soil that has not been well farmed, 100 to 300 pounds per acre of a complete fertilizer furnishing some nitrogen and potash, but principally phosphorus, probably is best. A little lime is also beneficial occasionally, but it is not necessary to add enough lime to neutralize the soil acidity in order to secure good crops of buckwheat. Although the point has not been determined definitely, it seems probable that the application of lime for the crop need not exceed 500 pounds an acre even on soils most deficient in lime.

VARIETIES OR TYPES OF BUCKWHEAT

Buckwheat belongs to the Polygonaceae or buckwheat family (fig. 2). Other common plants belonging to this family are dock, sorrel,

knotweed, black bindweed, and climbing false buckwheat.

Most of the buckwheat grown in the United States is either Japanese or Silverhull, two varieties or types belonging to the species *Fagopyrum esculentum*. Although Japanese and Silverhull usually are referred to as varieties they are more nearly types, as they vary greatly in characteristics of both plant and seed. In some areas a third type is referred to as Common Gray.

Japanese (fig. 3, A) probably is the most extensively grown and widely adapted type. The seed is brown in color and usually large in size. In cross section it is nearly triangular. The plants are tall and have large leaves and coarse stems and are a little more inclined to lodge than those of Silverhull.

Silverhull (fig. 3, D) usually is distinguished from Japanese by its smaller, glossy, silvery-gray seeds. The seed is more nearly round than triangular in cross section. The plants are smaller than those of Japanese, the

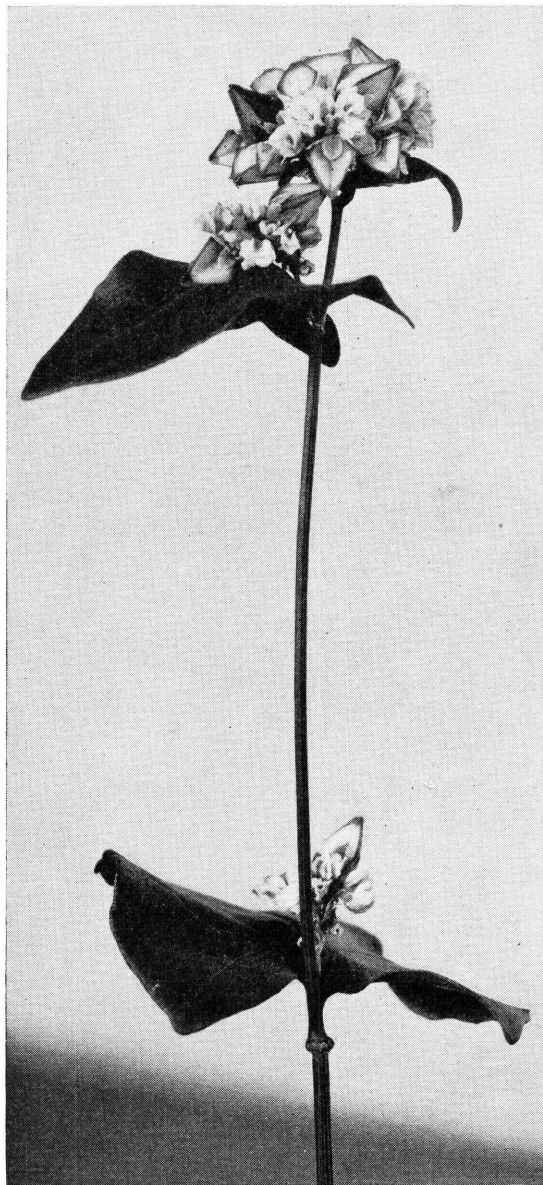


FIGURE 2.—Flowering branch of buckwheat.

stems not so coarse, and the leaves smaller. The stems of Silverhull seem to show a tendency to be more reddened at maturity than those of Japanese. Silverhull probably is most widely grown in New York.

Common Gray is very similar to Silverhull and probably is identical. In some areas the smaller gray-seeded type is called Common Gray, and the larger gray-seeded type is considered to be Silverhull. Japanese, Silverhull, and Common Gray are regarded as about equal for milling purposes, although one or the other may be favored locally. In some cases the milling yield of Silverhull is higher because of less hull. A more important factor in milling seems to be a uniform size of seed.



FIGURE 3.—Seed of four varieties or types of buckwheat: A, Japanese; B, *Fagopyrum emarginatum*; C, *F. tataricum*; D, Silverhull.

The varieties or types generally are not grown pure. It is a common practice to mix seed of Japanese and Silverhull in equal quantities. The reason often advanced is that the shorter growing Silverhull helps support the taller Japanese plants, and the taller plants shade the shorter ones in hot weather. It also is possible that

because of a slight difference in the blooming period, or for some other reason, one of the varieties may escape injury caused by unfavorable weather conditions. Common buckwheat is highly self-sterile and must be cross-pollinated to effect fertilization. Bees and other insects distribute the pollen. Hybrids thus occur in the mixture, and the following crops are of an intermediate type, having characteristics of both parents.

In the more important producing areas the type grown is controlled very largely by the mill using the crop. Seed of the desired type is saved in the fall or is shipped in and sold to the grower for sowing the next spring. In this way the mills can be more certain of obtaining the type of buckwheat they desire.

Another species of buckwheat, *Fagopyrum tataricum* (fig. 3, *C*), is grown in some places. It usually is known as Tartary buckwheat, but many other names are applied, such as "India wheat," "Rye buckwheat," "Duck wheat," "Bloomless," "Hull-less," "Marino," "Mountain," "Siberian," "Wild Goose," and "Calcutta." Seeds of Tartary are much smaller than those of ordinary buckwheat, nearly round in cross section, and usually pointed. The color ranges from dull gray to black and the seed coat from smooth to decidedly rough and spiny. The leaves are narrow and arrow-shaped. The plants are inclined to approach a vine condition. The flowers are very small and have inconspicuous greenish-white petals; the plants can thus be distinguished easily from those of ordinary buckwheat. Tartary buckwheat plants are self-fertile in contrast to the self-sterile condition in ordinary buckwheat.

Tartary buckwheat is grown in limited acreages in the mountains of North Carolina and Maine and in some sections of New York, Pennsylvania, and Maryland. It is preferred in those sections, because it is less subject to injury from frost and seems a little better adapted to the rougher, less favorable lands than the ordinary varieties. It seems better able to set seed than Japanese or Silverhull under unfavorable conditions at flowering time. This probably is due to the self-pollinating habit of the Tartary type.

Tartary buckwheat is inferior to the common varieties for flour making. It is reported to have a bitter taste and to transmit this taste to flour if it is present as a mixture. Its principal use in this country is as feed, especially for poultry. It may be fed whole to chickens, but it should be ground and bolted to remove the hulls before being fed to horses and hogs, as the hulls may cause dietary disturbances.

Probably the notch-seeded or wing-seeded buckwheat *Fagopyrum emarginatum* (fig. 3, *B*) is not grown in a pure condition in this country, although seeds of it sometimes can be found mixed with the common varieties. In this type the angles of the hulls are extended and form wide margins or wings. No differences are known other than shape of seed, and it probably should be considered only as a variety or type of Japanese buckwheat and not as a different species.

No improved varieties of buckwheat have been distributed in the United States. A few named varieties have been introduced, but their identity was soon lost. Some buckwheat breeding has been done, but as yet no marked improvement has been obtained other than in uniformity. The reasons for this are the difficulties in controlling pollination and the slight importance of the crop.

SEED AND SEEDING

SEED

Buckwheat to be used for seed should be cleaned thoroughly to remove broken seeds and foreign material, such as sticks, stems, and weed seeds. A better job of seeding can be done if the seed is clean and uniform. Buckwheat remains viable for several years, although the percentage of germination falls rather rapidly after the first year. It is best not to use seed more than 1 year old. Old seed should be tested for germination; if such seed is used, the rate of seeding should be increased in proportion to the decrease in germination.

DATE OF SEEDING

The best time to sow buckwheat is well along in the season after all danger of frost is past. Seeding must be done early enough to allow the buckwheat to mature before frost, because the plants are very sensitive to cold and are killed by the first heavy frost. Seeding is general in New York, Pennsylvania, and Michigan from June 24 to July 1. Seeding may be done either a week earlier or a week later than these dates, the earlier dates being safer for the more northern points in Wisconsin and New York. When sown at this time the crop is likely to escape injury from hot weather, which, with drying winds and hot nights, causes the flowers to blast and fail to produce seed. In a few areas some growers seed the crop earlier in the spring, hoping to have the seed set before hot weather. If buckwheat is seeded as a mixture with oats or barley the seeding is done in the early spring. It is seldom advisable to seed later than July 15. The seeding time for any locality may be determined fairly accurately by allowing a period of 12 weeks for growth before the first killing frost is expected. Under the most favorable conditions buckwheat will mature in 10 weeks, but the average time is 12 weeks. Harvest is general in New York and Pennsylvania from September 15 to 20.

Two crops of buckwheat have been raised on the same land in a single season in West Virginia. Although the practice is not recommended, it is possible where the growing season is of sufficient length. In such cases the second crop must be sown immediately after the first crop is harvested.

Buckwheat germinates best when the soil temperature is about 80° F., but it will germinate at any temperature between 45° and 105°. The plants usually come up in about a week. Blooming begins in about 5 or 6 weeks, gradually increases to a maximum, and then decreases. Some flowers continue to appear until the crop is harvested or frosted, because of the indeterminate growth habit of buckwheat plants. The first grains begin to ripen about 3 or 4 weeks after flowering starts, and ripening continues until frost.

METHOD OF SEEDING

Buckwheat may be sown with a grain drill or broadcast and harrowed in. The drill should be used where the nature of the field allows, as less seed is required and better covering and more uniform stands are obtained. Broadcasting the seed is a rather common practice because of rough, stony land, small fields, and lack of equipment. Buckwheat should not be covered by more than 2 inches of

soil or the plants will have trouble in coming up. Usually it is satisfactory to seed 1 to 2 inches deep, but this depends on the soil moisture and soil texture.

RATE OF SEEDING

Buckwheat should be seeded at the rate of 3 or 4 pecks per acre, although sometimes as much as 5 pecks is sown. As little as 2 pecks of seed of good vitality is sufficient when sown with a drill in fertile soil free from weeds. Often, however, the practice is to sow more heavily on rich land, as it is thought that the denser growth reduces lodging somewhat. A higher rate should be used if the seed is broadcast.

Tartary buckwheat requires less seed per acre than the larger seeded Japanese and Silverhull types. Two pecks of Tartary buckwheat per acre is usually considered sufficient.

Buckwheat branches freely and occupies considerable space on fertile land. On poor land, or when sown thickly, buckwheat forms few branches and there is less development of the plants. Buckwheat adapts itself to its surroundings by branching perhaps as effectively as other grain crops, although it does not tiller like wheat, rye, oats, and barley.

The approximate number of seeds to a pound of the different types of buckwheat is as follows: *Emarginatum*, 14,000; Japanese, 15,000; Silverhull, 20,000; and Tartary or "Rye," 26,000.

HARVESTING

Buckwheat may be harvested with a cradle, scythe, self-rake reaper, binder, or combine, the method or machine depending on the equipment available and the size and nature of the field.



FIGURE 4.—Harvesting buckwheat with a cradle.

A cradle often is used for harvesting (fig. 4) the smaller and very rough or rolling fields. The self-rake reaper (fig. 5) is satisfactory on larger and more level fields. Both of these devices drop the crop in loose bunches, which later should be gathered (fig. 6) and set in small, loose shocks. These shocks are made by setting up together several bunches from the cradle or reaper. The lower part of the bunch is separated slightly and the tops are twisted together or tied with strands of

straw. Such shocks, shown in figure 7, resemble small corn shocks.

The ordinary grain binder (fig. 8) may be used where the land is not too rough and the buckwheat is tall enough and standing well. Many fields may lodge so badly that harvesting with a binder is rather difficult unless the cutting is done by driving in only one

direction. The binder should be set to tie rather small bundles to permit thorough drying. The bundles from the binder should be set in shocks two bundles wide and three or four bundles long (fig. 9). Better shocks can be made and the loss from shattering will be less if buckwheat is shocked immediately after cutting and before the plants wilt. A binder causes some shattering because of jarring by the reel, canvas packers, and the tying mechanism. The loss, however, probably is no greater than when the crop is mowed, because fewer loose plants are left on the ground.

Combines have been used to harvest buckwheat in recent years in some sections. This machine reduces the losses from shattering, but the green, juicy stems, always present in buckwheat

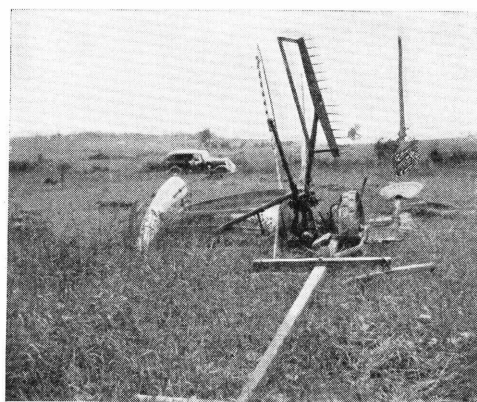


FIGURE 5.—Self-rake reaper often used to harvest buckwheat.

ready to harvest, may break up and are not readily removed in threshing. Also some green seeds are always on the plants. Consequently, the grain usually is too damp for safe storage until dried by spreading out on a floor or by passing it through some sort of artificial drier.

If a combine is used, harvest should be delayed as long as possible in order to allow the plants to mature as much as possible.

Buckwheat usually is harvested when the maximum number of seeds are ripe. If frost threatens, cutting may be started as soon as the first seeds start to ripen. Some of the nearly mature seeds will continue to ripen after cutting if the drying is not too rapid. Considerable loss from shattering will occur if the crop is left standing too long, and this loss may exceed the



FIGURE 6.—Bunching and shocking buckwheat cut with a cradle.

increase in yield from postponed cutting. Losses from shattering may be reduced by cutting in the morning when the dew is on, or in damp weather.

Buckwheat is ordinarily shocked in the field and left to dry until threshing time. This requires a week to 10 days of good weather. The crop may be stacked or stored in a mow if thoroughly dry.

THRESHING

Buckwheat is threshed with either a hand flail or a thresher. If a flail is used the straw should be dry and the weather fair, so the grain will shell out easily. The straw need not be so dry for machine

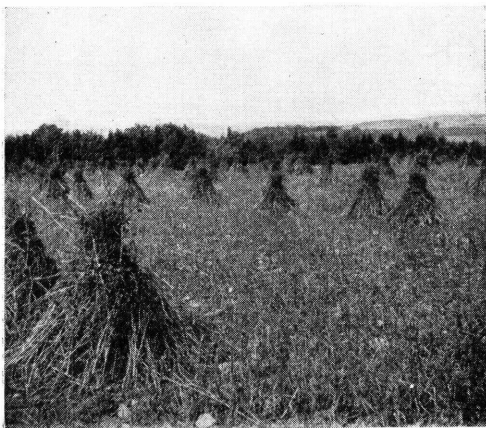


FIGURE 7.—Buckwheat in shocks made by setting up unbound bunches and tying the top with a strand of the plants.

threshing. For threshing buckwheat, the spiked concave should be removed and replaced with a blank concave or one with only a few teeth, or with a fitted plank, to prevent cracking the grain and breaking up the straw more than is necessary. Buckwheat threshes more easily than other cereals, because the pedicels or short stems which bear the kernels are slender and, when dry, are very brittle.

The legal weight of a bushel of buckwheat is 48 pounds, a weight established by Federal statute.

PLANT DISEASES AND ENEMIES

Buckwheat is particularly free from destructive plant diseases or insect enemies, and serious losses do not often occur from these causes. A leaf spot (*Ramularia* sp.) has been reported in certain sections of North Carolina, as has also damage from *Rhizoctonia* or root rot. Neither of these diseases has been reported as doing serious damage in the important buckwheat areas. The blasting of the flowers often occurs as a result of unfavorable climatic conditions but is not due to disease.

Wireworms have been reported as damaging the seed and roots of buckwheat in North Carolina. Under certain conditions aphids will attack the plants, undoubtedly doing some damage. Buckwheat is not injured by chinch bugs, and in Illinois buckwheat has been recommended as a crop upon which these insects neither feed nor increase.

Birds and poultry, when numerous, may consume a considerable quantity of the grain before it can be threshed.

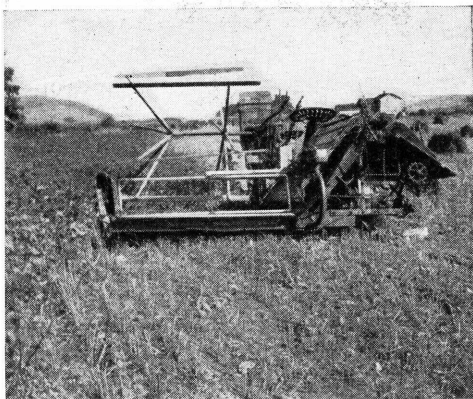


FIGURE 8.—Cutting buckwheat in New York State with a binder drawn by a tractor.

USES OF BUCKWHEAT

Buckwheat is used in the United States for making pancake flour. It may be used either as pure buckwheat flour or more commonly as an ingredient in prepared pancake flours. A prepared buckwheat flour is sold which is a mixture of buckwheat and wheat, corn, or rice flour. Buckwheat cakes probably are not eaten so extensively as formerly because of changing food habits. The batter requires yeast or some other leavening agent, and the general practice is to start the batter and keep it going all winter by adding more flour and water or milk each day as the day-old batter is used. This requires much more time than when the cakes are made from a modern prepared flour. The cakes generally are dark in color because of portions of hull in the flour. Buckwheat cakes are a rather heavy food for indoor workers.

Buckwheat groats are kernels with the hulls removed. Unbroken kernels are sold as whole groats, and those broken in milling are sold as medium and fine groats. The groats may be sold toasted or raw. Groats are used as breakfast food, porridge, and thickening for soups, gravies, and dressing, much in the same manner as corn meal. Japanese buckwheat is preferred for

the manufacture of groats because of the size and shape of the grains. Groats are used especially by people of French, Russian, Polish, or Jewish extraction. The demand for groats has been increasing, and some mills consider this product more in demand than buckwheat flour. Buckwheat flour and groats must be used fresh, as they soon become rancid owing to their high fat content. This poor keeping quality makes buckwheat products difficult to handle in the summer.

Considerable attention has been given to buckwheat cookery by the United States Department of Agriculture, especially in studies of wheat substitutes and their uses. Experiments also have been made on the digestion of buckwheat. Those interested in these subjects or in the food values of buckwheat as compared with those of other grains can obtain such information on request from the Bureau of Home Economics, United States Department of Agriculture, Washington, D. C.

When buckwheat is eaten steadily, or in too large quantities, it sometimes causes a rash to appear on the skin of man and of certain animals. This rash seems to be confined to white-colored animals and apparently has some connection with the light relationships of the animal, as it occurs only in animals exposed to light. The substance that produces these effects apparently is located in the hulls, particles of which are contained in the flour.



FIGURE 9.—Buckwheat shocks made by setting up bundles from a binder. Note the long, narrow shock that permits thorough drying.

The outer hulls of buckwheat removed in milling are used for fuel, as packing material for bottled goods and bulbs, and to some extent as an ingredient in mixed livestock feeds. The hulls contain considerable carbohydrate and other nutrient material and are of some small value as feed.

The buckwheat middlings obtained in milling are composed of the inner covering of the grain just beneath the hull, together with the germ of the kernel. These middlings contain considerable protein, carbohydrates, fat, and mineral matter and are considered good feed for cattle. They are used principally by dairymen. They apparently have no bad effects on the animals or the dairy products if not fed in excess or as the only concentrate. The manure from livestock fed with middlings has a high fertilizing value, because of the nitrogen, phosphorus, and potassium contained in it.

Buckwheat bran and buckwheat feed are mixtures of the middlings and the hulls. They vary in composition but are usually much poorer as a feed than the middlings alone.

Buckwheat may be mixed with oats and barley as a livestock feed. In some cases it is seeded as a mixture with barley or oats, and the resulting crop is used as a grain feed.

The whole grain may be used as a poultry feed. For this purpose Tartary buckwheat probably is better than the other types, because of the smaller size of the seed. The seed of Japanese and Silverhull may be a little large to be fed whole. Buckwheat is used in many mixed poultry feeds, being popular with feed dealers, because the kernels show up well in the mixture.

The straw sometimes is used for feed and is eaten readily by livestock if well preserved. It is rich both in minerals and carbohydrates. It makes good bedding for cattle but does not last well. The straw makes a good manure because of its high mineral content and because it rots quickly.

AS A FEED

Buckwheat grain contains, on an average in each 100 pounds, 10.8 pounds of crude protein, 72.5 pounds of carbohydrates, and 2.5 pounds of fat. The same quantity of straw contains 5.2 pounds of crude protein, 78.1 pounds of carbohydrates, and 1.3 pounds of fat. Buckwheat grain contains a little less crude protein than wheat, rye, and oats and about the same amount as corn. It has more fat than wheat and rye and about one-half as much as oats and corn. It contains about three-fourths as much digestible carbohydrates as wheat, rye, and corn and about the same amount as oats. Buckwheat straw contains about two-thirds more crude protein than the straw of wheat, rye, or oats and about the same amount as corn stover. It contains about as much fat as corn stover or wheat or rye straw and half as much as oat straw. In digestible fat, buckwheat straw is superior to any of these others, containing from about one-third more to three times as much. It contains less digestible carbohydrates than corn stover or the straw of these other grains.

AS A WEED DESTROYER

Buckwheat germinates quickly after being sown, makes a rapid growth, and shades the ground quickly and completely where the soil is not too poor. This heavy growth smothers many weeds.

Buckwheat is useful in fighting quack grass, a pest on many farms in the Northeastern States. Some farmers report the complete eradication of quackgrass in a single season by smothering it with buckwheat, but such rapid control usually is not to be expected. The land should be cropped a year to corn or other cultivated crops to get rid of the quackgrass sod, then plowed in the fall or early spring, and harrowed occasionally until buckwheat-sowing time. Some manure and fertilizer should be added if the land is poor. A heavy stand, such as may be secured from 4 to 5 pecks of buckwheat seed to the acre, should be obtained. If the land is rich enough the heavy growth of buckwheat should smother most, if not all, of the quackgrass, and a good crop of grain also will be produced. Thus buckwheat is valuable in two ways, namely, in saving the labor of working the land all summer to keep down the quackgrass and in returning a crop of grain.

AS A SOIL RENOVATOR

Buckwheat has great value as a soil renovator. It can utilize relatively insoluble mineral soil constituents to good advantage, and when plowed under as green manure it renders this plant food available, besides furnishing humus to the soil. A heavy growth plowed under decays more quickly and completely than most other green manure crops, leaving the residues soon available for a succeeding crop. A crop of buckwheat also leaves even hard soils in a loose, friable condition, supposedly in part because it completely shades the ground. Land intended for potatoes is benefited by a crop of buckwheat.

Very poor land can be built up by sowing rye with the buckwheat. The two grains are sown at the regular time for sowing buckwheat; the mixture is sown at a lower rate than buckwheat alone would be but at about the same rate as rye alone, i. e., about 5 or 6 pecks per acre. The rye is shaded and held in check by the more rapidly growing buckwheat until the latter is harvested, after which the rye develops and occupies the land over winter. The rye is plowed under as green manure in the spring. This process can be repeated year after year until the land is improved sufficiently to grow other crops. An application of lime will generally be necessary for growing clovers, which should be grown for the nitrogen that they supply.

The rye also can be sown in the fall after the buckwheat crop is removed, and this often may be the most feasible practice. The rye may be drilled in the buckwheat stubble, but previous disking or even plowing of the land sometimes may be necessary. Probably the quickest and best way to improve very poor land is to plow under both the buckwheat and rye crops at least the first year. In any case rye or some other fall-sown crop should follow the buckwheat to prevent erosion.

AS A CATCH CROP

Because of the relatively short growing season of buckwheat, it may be used as a catch crop. Where spring crops like oats or corn have failed to make a stand ample time is still available for a crop of buckwheat. In certain parts of the Spring Wheat Belt, especially northeastern South Dakota, buckwheat has been seeded after stands of

spring wheat failed, thus making possible some return from the land. The crop also may be used where the land cannot be worked until so late that the seeding of longer season crops will be hazardous.

AS AN ORCHARD COVER

Buckwheat seeded alone at the usual rate per acre frequently is used as a green-manure or summer cover crop in orchards and vineyards. The advantages of having a legume in the cover crop are gained by adding Canada peas. Buckwheat and Canada peas mixed have been found very satisfactory for this purpose in New York. Perhaps the only objection to this combination is that the very rank growth, averaging about 2½ feet in the latter part of September, interferes rather seriously with the gathering of fruit, especially on wet days. This may be obviated by rolling down the buckwheat before beginning the apple harvest. The straw carpet thus obtained is useful in preventing injury to the apples falling upon it.

AS A HONEY PLANT

Buckwheat is an important fall honey plant in the buckwheat region, particularly in New York and Pennsylvania. Numerous flowers are produced on each plant, and a plant may continue to bloom for a month or more. A field of buckwheat at blooming time presents a mass of flowers, as shown in figure 10. The flowers are usually well supplied with nectar, each one having eight nectaries.



FIGURE 10.—Field of Japanese buckwheat in full bloom.

Buckwheat honey is dark and has a distinctive flavor. It usually is highly regarded in sections where it is produced, being preferred by many to more mildly flavored honeys. It nevertheless commands a lower price than some of the lighter colored clover honeys.

Beekeeping in buckwheat-growing sections serves a dual purpose, for the buckwheat serves as a source of honey rather late in the season and at the same time the bees help to fertilize the flowers. Many buckwheat growers believe that the seed set is heavier where the flowers have been heavily worked by bees. It is not advisable to grow buckwheat solely as a honey plant. It can be grown, however, to supplement the other honey flora, but its primary purpose should be as a grain or green-manure crop, or as a weed destroyer or soil renovator.

MILLING¹

Various methods are employed in the milling of buckwheat. A few mills still use old-fashioned stone burs, but the greatest number use steel rolls. The milling process may be described briefly as follows: The grain is first cleaned thoroughly, to remove dirt and foreign material. It is then dried to approximately 12-percent moisture and scoured, to remove dust, fuzz, and the calyx adhering to the fruit. The grain is then passed through the first break rolls, where the hulls are cracked and loosened from the kernel. During this process some moisture may be taken up, and following this first break the material is again dried to 12-percent moisture, to aid in separating the hulls from the kernels. The broken grain then goes to sieves, which remove the hulls and separate the flour. The material left is reduced by one or more sets of rolls, each grinding operation followed by a sifting, which removes the flour from the middlings. Some buckwheat flour is milled so fine and is so refined that it is as white as wheat flour. Usually, however, coarser bolting cloths are used, through which small particles of hull pass and remain in the flour, thus giving the flour a characteristic dark color.

Mills vary in the yield of flour obtained from buckwheat. On an average, 100 pounds of clean, dry buckwheat will yield from 60 to 75 pounds of flour, from 4 to 18 pounds of middlings, and from 18 to 26 pounds of hulls. Not more than about 52 pounds of pure white flour from 100 pounds of grain is obtained in milling. Buckwheat more than 1 year old is reported to make flour inferior to that made from new grain.

In milling for groats it is necessary to grade the grain carefully for uniform size. After being cleaned, the grain is passed between two millstones so adjusted that they crack the hull without breaking the groats more than is necessary. The product is sieved to remove the hulls, and all dust is taken out by aspirator purifiers. It is then graded into whole groats and two or more sizes of broken groats.

Tartary buckwheat is not used in milling, because the flour has a dark color and a bitter taste. Many millers consider the variety so objectionable for milling that they refuse to buy any buckwheat that contains Tartary as a mixture.

¹For a complete discussion on milling and chemical composition of buckwheat the reader is referred to U. S. Department of Agriculture Circular 190, Buckwheat and Its By-products.

